

## CLAIMS

What is claimed is:

1. A tunable microwave multiplexer, comprising:
  - a plurality of channel filters comprising at least one resonator; and
  - a combining/dividing mechanism coupled to said plurality of channel filters comprising:
    - a common port; and
    - a common resonator coupled to said common port.
2. The tunable microwave multiplexer according to claim 1, wherein said at least one resonator is a combline resonator.
3. The tunable microwave multiplexer according to claim 1, wherein said at least one resonator is a dielectric loaded resonator.
4. The tunable microwave multiplexer according to claim 1, wherein said at least one resonator is a ceramic resonator.
5. The tunable microwave multiplexer according to claim 1, wherein said at least one resonator is a metallic resonator.
6. The tunable microwave multiplexer according to claim 1, further comprising transmission ports coupled to said plurality of filters.
7. The tunable microwave multiplexer according to claim 1, wherein at least one of said plurality of said channel filters comprises more than one filter section.

8. The tunable microwave multiplexer according to claim 1, wherein said at least one resonator comprises a tuning element assembly, whereby a resonant frequency can be adjusted.
9. The tunable microwave multiplexer according to claim 1, wherein said common resonator is a coaxial resonator.
10. The tunable microwave multiplexer according to claim 1, wherein said common port is coupled to said common resonator using a tapped-in or loop configuration.
11. The tunable microwave multiplexer according to claim 1, wherein said common resonator further comprises coupling apertures, wherein said plurality of channel filters is coupled to said plurality of coupling apertures.
12. The tunable microwave multiplexer according to claim 1, wherein said common resonator comprises an adjustment screw, whereby said adjustment screw is used to adjust the resonant frequency of said common resonator.
13. The tunable microwave multiplexer according to claim 1, wherein said common resonator comprises:
  - an enclosure;
  - a cavity positioned inside said enclosure; and
  - an inner conductor positioned in said cavity.
14. The tunable microwave multiplexer according to claim 1, wherein said more than one resonator is connected in series with at least one other resonator.
15. The tunable microwave multiplexer according to claim 7, wherein said more than one filter section is connected in series with at least one other filter section.

16. The tunable microwave multiplexer according to claim 9, wherein said coaxial resonator is a multiple half-wavelength coaxial resonator.

17. The tunable microwave multiplexer according to claim 11, wherein said coupling apertures are positioned at peaks of a magnetic field.

18. The tunable microwave multiplexer according to claim 12, wherein said adjustment screw is positioned where the electric field is a maximum in said common resonator.

19. The tunable microwave multiplexer according to claim 13, wherein said inner conductor is milled into said cavity.

20. The tunable microwave multiplexer according to claim 13, wherein said inner conductor is affixed into said cavity.

21. The tunable microwave multiplexer according to claim 13, wherein said inner conductor is made using the same conductive material as that used for the common resonator's enclosure.

22. A tunable microwave multiplexer, comprising:

a plurality of channel filters comprising at least one resonator; and

a combining/dividing mechanism coupled to said plurality of channel

filters via coupling apertures, comprising:

a common port, and

a multiple half-wavelength coaxial resonator coupled to said common port; and

transmission ports coupled to said plurality of filters.

23. The tunable microwave multiplexer according to claim 22, wherein said coupling apertures located on said enclosure wall of said common resonator are positioned at peaks of a magnetic field.

24. The tunable microwave multiplexer according to claim 22, wherein said common port is coupled to said common resonator using a tapped-in or loop configuration.

25. The tunable microwave multiplexer according to claim 22, wherein said at least one resonator is a combline resonator.

26. The tunable microwave multiplexer according to claim 22, wherein said at least one resonator is a dielectric loaded resonator.

27. The tunable microwave multiplexer according to claim 22, wherein said at least one resonator is a ceramic resonator.

28. The tunable microwave multiplexer according to claim 22, wherein said at least one resonator is a metallic resonator.

29. The tunable microwave multiplexer according to claim 22, wherein said at least one resonator comprises a tuning element assembly, whereby a resonant frequency can be adjusted.

30. The tunable microwave multiplexer according to claim 22, wherein said multiple half-wavelength coaxial resonator comprises:

- an enclosure;
- a cavity positioned inside said enclosure; and
- an inner conductor positioned in said cavity.

31. The tunable microwave multiplexer according to claim 22, wherein said at least one resonator is connected in series with at least one other resonator.

32. The tunable microwave multiplexer according to claim 22, wherein said inner conductor is milled into said cavity.

33. The tunable microwave multiplexer according to claim 22, wherein said inner conductor is affixed into said cavity.

34. The tunable microwave multiplexer according to claim 22, wherein said multiple half-wavelength coaxial resonator comprises an adjustment screw, whereby said adjustment screw is used to adjust the resonant frequency of said multiple half-wavelength coaxial resonator, wherein said adjustment screw is positioned where the electric field is a maximum in said common resonator.

35. A microwave communication system, comprising:

a receiver;

a signal processor coupled to said receiver; and

at least one antenna coupled to said receiver;

wherein said receiver comprises at least one tunable microwave multiplexer, comprising:

a plurality of channel filters comprising at least one resonator; and

a combining/dividing mechanism coupled to said plurality of channel,

comprising:

a common port, and

a multiple half-wavelength coaxial resonator coupled to said common port; and

transmission ports coupled to said plurality of filters.

36. The tunable microwave multiplexer according to claim 35, further comprising coupling apertures coupling said combining/dividing mechanism and

said plurality of channel filters, wherein said coupling apertures are located on said enclosure wall of said common resonator, positioned at peaks of a magnetic field.

37. The tunable microwave multiplexer according to claim 35, wherein said common port is coupled to said common resonator using a tapped-in or loop configuration.

38. The tunable microwave multiplexer according to claim 35, wherein said at least one resonator comprises a tuning element assembly, whereby a resonant frequency can be adjusted.

39. The tunable microwave multiplexer according to claim 35, wherein said multiple half-wavelength coaxial resonator comprises:

- an enclosure;
- a cavity positioned inside said enclosure; and
- an inner conductor positioned in said cavity.

40. The tunable microwave multiplexer according to claim 35, wherein said at least one resonator is connected in series with at least one other resonator.

41. The tunable microwave multiplexer according to claim 35, wherein said multiple half-wavelength coaxial resonator comprises an adjustment screw, whereby said adjustment screw is used to adjust the resonant frequency of said common resonator, wherein said adjustment screw is positioned where the electric field is a maximum in said common resonator.

42. A microwave communication system, comprising:

- a transmitter;
- a signal processor coupled to said transmitter; and
- at least one antenna coupled to said transmitter;

wherein said transmitter comprises at least one tunable microwave multiplexer, comprising:

a plurality of channel filters comprising at least one resonator; and

a combining/dividing mechanism coupled to said plurality of channel filters, comprising:

a common port, and

a multiple half-wavelength coaxial resonator coupled to said common port; and

transmission ports coupled to said plurality of filters.

43. The tunable microwave multiplexer according to claim 42, further comprising coupling apertures for coupling said combining/dividing mechanism and said plurality of channel filters, wherein said coupling apertures are located on said enclosure wall of said common resonator, positioned at peaks of a magnetic field.

44. The tunable microwave multiplexer according to claim 42, wherein said common port is coupled to said common resonator using a tapped-in or loop configuration.

45. The tunable microwave multiplexer according to claim 42, wherein said at least one resonator comprises a tuning element assembly, whereby a resonant frequency can be adjusted.

46. The tunable microwave multiplexer according to claim 42, wherein said multiple half-wavelength coaxial resonator comprises:  
an enclosure;  
a cavity positioned inside said enclosure; and  
an inner conductor positioned in said cavity.

47. The tunable microwave multiplexer according to claim 42, wherein said at least one resonator is connected in series with at least one other resonator.
48. The tunable microwave multiplexer according to claim 42, wherein said multiple half-wavelength coaxial resonator comprises an adjustment screw, whereby said adjustment screw is used to adjust the resonant frequency of said common resonator, wherein said adjustment screw is positioned where the electric field is a maximum in said common resonator.
49. A method of multiplexing a plurality microwave channel frequencies, comprising:
  - inputting a signal comprising a plurality of frequency channels into a common resonator;
  - maintaining the phase difference between a common port of a common resonator to each RF port of a plurality of cavity channel filters at approximately 0 or 180 degrees;
  - separating said signal comprising a plurality of frequency channels; and
  - outputting at least one of said plurality of frequency channels.
50. The method of multiplexing microwave channel frequencies according to claim 49, wherein said step of separating said signal, comprises:
  - coupling said signal comprising a plurality of frequency channels at peaks of a magnetic field within said common resonator to a plurality of channel filters; and
  - filtering the frequency channels of said signal using said plurality of channel filters.
51. The method of multiplexing channel frequencies according to claim 49, further comprising the step of adjusting the resonant frequency of said common resonator.



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